Teddy Nichols v. AEP, et al.

Our Case # 2004-016w

Client Case # 2176-61

Report Date:
March 12, 2004

Prepared for:
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March 12, 2004

Mr. Todd Powers
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Dear Mr. Powers:

Attached hereto and incorporated with this letter are my preliminary observations and opinions regarding this case based upon the information received and reviewed to date and any work including testing, calculations, simulations, research or interviews that Ruhl Forensic, Inc. has performed. I hold these opinions to be true to a reasonable degree of biomechanical, human factors and accident reconstruction certainty. The methods I have used in my analysis follow those commonly used and accepted in these fields. I base my opinions upon review of the listed materials, my education, training and experience.

As additional information is made available to me or as new facts are uncovered, my opinions may change to reflect the newfound information. Should this case go to trial, I expect to use any attached or referred to figures, photographs, videotapes, simulations or documents as exhibits.

Very truly yours,

RUHL FORENSIC, INC.

By Mark Strauss
Mark G. Strauss, Ph. D.

BACKGROUND

Mr. Terry Nichols was a 31 year old deck hand when he worked on an AEP towboat. Part of his employment responsibility was to work with another deck hand to switch out empty barges with full barges of coal at the Philip Sporn Power Plant coal unloading facility in West Virginia. Mr. Nichols states that he injured his shoulder while receiving the transfer of the up-river haul-out cable.

Mr. Todd Powers contacted Ruhl Forensic, Inc. on February 12, 2004 to evaluate the appropriateness of the conditions under which Mr. Nichols was performing this cable transfer.

MATERIALS REVIEWED

Materials reviewed as of this date include:

1. Complaint and Plaintiff's Supplemental Identification of Expert Witnesses including reports from Dr. Herrin and Mr. Campana.

2. Deposition transcripts of Mark Clay, Jeff Darst, Charles Johnson, Robert McCleary, Teddy Nichols, Timothy Ramey, Larry Todd, Michael Weisend.

3. Stipulation of Facts including drawings for the barge storage area at the Philip Sporn Plant.

4. Videotape taken by Mr. Schroeder of the inspection that took place on September 25, 2003.

5. Report of Mr. John Deck.

6. Various AEP forms and memos regarding this accident.

7. Medical records for Mr. Nichols.

8. On-site inspection of barges and observation of personnel at the Philip Sporn Plant.

9. Work Practices Guide for Manual Lifting, NIOSH, 1981.

10. Scientific Support Documentation for the revised 1991 NIOSH Lifting Equation: Technical Contract Reports, NIOSH, 1991.

11. 3D Static Strength Prediction Program 4.3 and Manual, University of Michigan.

12. Working Model computer program.

CONCLUSIONS

1. The testimony and hand written documents created by Mr. Nichols leads to the conclusion that Mr. Nichols did not and does not know what caused his shoulder injury. He does not know when it occurred and it could have occurred at home or at work.

2. If Mr. Nichols thought that a haul-out cable being passed to him required more force to handle than was comfortable for him, he could have and should have let go of it. There is no negative consequence for this.

3. Mr. Nichols' description of being injured while being passed the haul-out cable is not reasonable. During my inspection, no force was found in the haul-out line that would cause injury. If Mr. Nichols was ever subjected to a force great enough to damage his cervical spine and create a traumatic tear of the glenoid labrum, and also a rotator cuff tear, it is not anticipated that he would have continued to hold onto the pull-out line and complete the task of placing it on the timberhead.

4. If a force of 178 pounds was suddenly exerted on the line that Mr. Nichols was holding, as proposed by Dr. Herrin, the line would have either been wretched from his hands or he would have fallen over because he would not have been expecting it and his stance would not support stability.

5. The analysis performed by Dr. Herrin is not scientific. It inaccurately models the position of Mr. Nichols at cable hand-off, and the direction and magnitude of the load on Mr. Nichols from the haul-out line. Using this information as input to Dr. Herrin's 3D SSPP computer program yielded grossly incorrect results. Dr. Herrin's opinions are based upon these results.

6. Mr. Campana contradicts Dr. Herrin 178 pound impact theory when he says that the deck hand "is required to potentially hold a minimum of 175 pounds" when moving the haul-out line from the empty to the full barge. The upper deck hand would not be able to remove the line from the empty barge timberhead if it required a force of 175 pounds.

7. Observation and measurements of deck hands manipulating haul-out cables were performed by Dr. Strauss. His measurements show that the task of passing the up-river haul-out cable between deck hands is a reasonably safe task for both people. No additional manpower or equipment are needed to safely perform this task.

8. During the inspection by Dr. Strauss, the decks of all barges were found clean. There were no loose objects, debris or particulate matter to create tripping or slipping hazards. All personnel were seen wearing appropriate safety equipment.

DISCUSSION

Testimony by Mr. Nichols
Mr. Nichols testified that he was first hired in February 1996 by AEP at which time he was given training on how to be a deck hand by an experienced watchman, and was given a safety rule book (p. 28-30)[1]. He has worked on "line haul boats" for four years and would handle the fore and aft wires, ratchets and riggings.

Mr. Nichols recalls his accident occurring on Monday, August 27, 2001 at about 10:30 a.m. and the weather was not a contributing factor (p. 43).

Mr. Nichols says his injury occurred during the following procedure: His towboat, the Lakin Terminal, brought a loaded barge along side a barge that had been emptied by the power plant crane. He boarded the full barge, which was low in the water, and another deck hand, Tim Ramey, boarded the empty barge, which was lighter and higher in the water. They both walked the length of the barges to the up-river ends where Mr. Ramey unhooked the haul-out line from the land-side of the empty barge, walked the width of the barge to the river-side and passed the line down to Mr. Nichols, who was standing on the lower, full barge. Mr. Nichols then attached the line to the timberhead, within a few feet of where he was standing. Mr. Nichols testified (p. 45) that during this pass-off procedure, when he grabbed a hold of the line from Mr. Ramey, Mr. Ramey "... let it loose. It jerked me almost to the point of in the river. I put the cable on the timberhead. It felt at the time as if somebody had a knife stuck in my shoulder." Mr. Nichols recalls that Mr. Ramey was 10-15 feet above him (p. 54, 63) and therefore he could not see all of what Mr. Ramey was doing on the taller barge (p. 60). He states that Mr. Ramey did not drop the eye but handed down the eye (p. 64) so that Mr. Nichols could and did grab a hold of the eye (p. 59) probably with two hands (p. 61), that it appeared that there was going to be enough slack to get it to the timberhead (p. 61) and that, "there was no slack from the beginning" (p. 59). Mr. Nichols does not recall if he had to reach up to get the eye, or if it was face, chest or stomach high (p. 65). Mr. Nichols testified that when the line jerked, he did not let go of it, it pulled his upper body forward towards the river and the barge and then it stopped (p. 62). He states that in the past, the line has jerked to cause him to fall once and to let go of the line once (p. 67) but it has never jerked him this hard before (p. 85). Mr. Nichols stated during his deposition that prior to his accident, he complained that there was not enough slack in the line and this was dangerous (p. 68).

Testimony of Mr. Timmothy Ramey, deck hand and co-worker with Mr. Nichols
Mr. Ramey testified that there is probably an eight-foot height difference between the empty and full barges. He stated that he would hand the eye of the up-river line down to Mr. Nichols (p. 21). If there is not enough slack in this cable, the person on the empty

[1] Reference to page number in deposition transcript.

barge can't carry it across and it would jerk the man on the loaded barge (p. 23). Mr. Ramey has requested more slack from the tub boat pilot by using hand signals, who then coordinates that with the crane operator (p. 25). Mr. Ramey can judge how much slack is in the cable by picking the eye up off the timberhead (p. 29). Sometimes they are in a rush to unload barges and the person on the empty would not ask for more slack (p. 30). Mr. Ramey stated that there have been times prior to Mr. Nichols' injury that the cable has pulled him hard where Mr. Ramey had been, "... just about pulled off or I have to let go of the cable" (p. 46). Even though Mr. Ramey was working with Mr. Nichols, Mr. Ramey testified that he did not witness the injury and that Mr. Nichols first mentioned that his shoulder was hurting shortly after arriving at work, before any barges were changed out (p. 52-53).

Testimony by Mr. Michael Weisend, Safety Supervisor at AEP
Mr. Weisend testified that he spoke to Mr. Nichols on 8/28/01 and Mr. Nichols said that he did not know how he was injured, or whether it occurred at home or work. Mr. Weisend does not recall Mr. Nichols talking about being pulled by the haul-out cables.

Testimony of Mark Clay, towboat pilot
Mr. Clay stated that he was the supervisor of the two deck hands, and at that time, neither deck hand had a radio. If the deck hands were on the opposite end of the barge tp where he was, they communicated by hand signals to him, and he determined that both Mr. Ramey and Mr. Nichols knew how to use correct hand signals (p. 97). If the deck hands wanted more cable, they would signal him (p. 50,59,64,65,66,70). However, if they were on the same end of the barge as Mr. Clay was while he was in the towboat, they were close enough to just speak to him. Mr. Clay does not recall Mr. Ramey, Mr. Nichols or any other deck hand complaining that there was not enough slack in the haul-out cables (p. 63,67). Mr. Clay states the first time that Mr. Nichols came to him complaining that his shoulder hurt, Mr. Nichols said he did not know if he did it at work or at home (p. 72), and he could not tell me what he did (p. 75). Mr. Clay says that he has handled the cable before and that you would know "off the bat" if there was not enough slack as soon as the deck hand went to lift the eye off the empty barge, and if there is slack, it is easy (p. 91).

Testimony of Jeff Darst, AEP Production Services Leader
Mr. Darst said that no one has complained to him about the awkwardness of handling the cables.

Report of Accident or Illness, 8-29-2001
This report, signed by Mr. Nichols' immediate supervisor and towboat pilot, Mark Clay, document the accident type as "unknown", and the source of injury as "unknown." Even though the question that asks what was the injured doing at time of accident had choices which included "handling material," "lifting," and "pulling/pushing," the choice labeled "other" was selected and the description part is blank.

Accident and Injury Reporting Form, 9-6-2001
This form was filled out and signed by Mr. Nichols and he describes the accident happened as, "Pulling and jerking wires." The date of the accident is 8-28-2001.

AEP Personal Injury Memo, 9-19-2001
Mr. Nichols signed the bottom of this memo, and he hand wrote in additional information, the summation of which says that he cannot identify what caused his shoulder pain and had not pulled cables on the day he noticed the pain. He said he noticed the discomfort on the evening of 8-27-2001 and went to work the next day, "...and told Mark [Clay] and Tim [Ramey] my shoulder was sore from something."

Barge Inspection by Dr. Strauss
On March 4, 2004 I went to the Sporn Power Plant where I boarded a towboat and observed two deck hands perform the operation of changing out an empty barge with a full one.

Inspection and measurements revealed that the up-river haul-out line was comprised of a 1.8-inch diameter rope, approximately 10' 10" long, that was attached to a 3/4-inch diameter wire rope (steel 6x25 IWRC braided where one foot weighs 1.0 to 1.04 lbs.) With the haul-out line draped overboard, the weight on the terminal end was measured with a AMETEK AccuForce III digital force meter. The measurement was taken with the eye at stomach to chest level and ranged between 26.9 to 35 pounds.

Observation of the kinematics of the men while they moved the haul-out line on the up-river end showed that they performed in a casual manner with no undue stress for either individual. The deck hand on the empty (upper) barge lowered and swung the eye of the rope down to shoulder height of the man on the full (lower) barge. The man on the lower barge did not have to reach overhead nor pull down on the rope, however he chose to reach up higher than necessary. After grasping the rope eye with two hands, the lower deck hand simply bent down and placed the eye over the nearby timberhead on the full barge. The operation was videotaped and photographs and measurements were also taken.

Observing the transfer of the haul-out line on the down-river end of the barges showed that this task was easily performed by one deck hand.

Interview with Deck Hand & Pilot
During my inspection on March 4, 2004, I spoke to Deck Hand David Gram and inquired what are the ramifications if a deck hand dropped a cable and it fell into the river. He said there were no consequences and stated that new deck hands do it quite often. He said that if someone for some reason thought that the haul-out line did not have enough slack, they just ask for more, and if they were having difficulty holding it for whatever reason they could just drop it.

I also spoke to the towboat pilot, Ed Grimes, who said that he was able to view both deck hands, and their hand signals, while they were on the up-river end of the barges and he was in the wheelhouse of the towboat on the down-river end. I confirmed this by going into the wheelhouse and viewing the people at the opposite end of the barge. This is documented in photographs.

Strength Requirements as Modeled by Dr. Strauss

The University of Michigan 3D Static Strength Predication Program (3D SSPP) was used by Dr. Strauss to model Mr. Nichols and the haul-out cable force. Using as inputs to this program Mr. Nichols height and weight, body postures observed, the tasks required and haul-out cable force measured during my inspection, I found that 99% of all males would have the strength in their elbows and shoulders to perform the first task, which was cable hand-off, and the second task of tying the cable down. The loads in the shoulders were also considered satisfactory according to the guidelines issued by the U.S. National Institute for Occupational Safety and Health. This was also obvious by watching the deck hands perform the hand-off operation.

Review of Dr. Herrin's Analysis

As observed during my inspection, and documented on videotape and photographs, the haul-out line hand-off between the two deck hands is a smooth process. The upper deck hand lowers the line to the lower deck hand and the lower deck hand reaches in front of him approximately 16" to grab it. The upper deck hand then releases his end and the lower deck hand secures the line on the timberhead.

I have reviewed Dr. Herrin's report and there are three global points that I will address.

1- I reviewed the videotape taken by Mr. Schroeder that showed how Dr. Herrin measured the force in the haul-out cable to which Mr. Nichols was subjected. The method employed was throwing the haul-out line overboard and allowing it to snap taught and measuring the peak of the shock load. For many reasons, this will not measure the true load that a deck hand will experience.

a) The initial and final height of the line dropping during Mr. Herrin's test far exceeds the real transfer situation that the deck hands experience.

b) Allowing the line to snap taught and measuring a peak tensile load of 178 pounds is a poor approximation of reality. This situation will create artificially high impact loads that will not be felt by the deck hand. As observed on the videotape, (the real world situation), the haul-out line does not snap taught. There is a time interval during which the line drops down from the upper deck hand, rubs against the edge of the barge and strikes the lower barge edge, which dissipates some of the falling kinetic energy and also elongates the time interval that the lower deck hand experiences a load. In addition, because humans are intelligent and adaptable, and our muscles are not steel cables but a visco-elastic material, we consciously and unconsciously position and move ourselves to mitigate force on our bodies. The result is that we move our limbs to elongate the interval over which a short duration load is applied to our body in order to decrease the peak load. The nearly 11-foot long fiber rope attached to the steel cable is an added measure of safety which, because of its compliance, will absorb and elongate applied tensile loads. The large diameter of the fiber rope also makes it easier, safer and more comfortable for the deck hands to handle.

2- A model is an approximation of reality, and what the user of a modeling program enters as inputs will of course affect the accuracy of the results. From reviewing the 3D SSPP report pages attached to Dr. Herrin's report, it is seen that the input parameters used in all three of his models are not faithful representations of reality.

a) The first sub-task modeled by Dr. Herrin is labeled "Nichols1." The data input pages show that this is a model of a person standing. The arms are almost completely extended with the hands positioned in front of and above the head. The combined load on the hands is 178 pounds, pulling horizontally away from the face of the human model.

As stated previously, the *magnitude* of 178 pounds is never felt by Mr. Nichols at any time – a maximum load of 35 pounds is what I measured. Thus the magnitude of the applied load in this sub-task is incorrect.

The *direction* of the 178-pound load on the hands has been applied horizontally, perpendicular to the chest of the human model. This of course is incorrect as the direction of the force on the haul-out line that Mr. Nichols' is holding is primarily down, due to gravity. The only way that a force due to gravity could act in a purely horizontal direction is if the haul-out line went over a pulley (or some other object) on the empty barge, which redirected its line of action. In reality, there was no pulley or any other object that would cause a 178-pound horizontal load on Mr. Nichols. Thus the *direction* of the applied load is incorrect.

Lastly, regarding the first sub-task model, the *geometry* of the hands with respect to the body and the orientation of the arms is not an accurate representation of reality. During my inspection, and documented on my videotape, it was seen that the lower deck hand first touched the terminal end of the dangling haul-out line when it was approximately at the height of his head. And, after grasping it and the upper deck hand releasing the line, the lower deck hand lowered his arms before any load from the haul-out line was felt by him, as the line takes a finite amount of time to drop.

A graphic depiction of the total inappropriateness of how this model was set-up is shown on the 3D SSPP "Analysis Summary" page for this sub-task, which I have copied directly from the report of Dr. Herrin and show below in Figure 1. This bar graph shows the percent of the total male population (including all body weights and heights) that would be able to have the strength in their elbow, shoulder, torso, hip, knee and ankle to perform the task as modeled by Dr. Herrin. You will notice there are no black bars next to any of the joint names, and to the right of the graph there is a zero next to all six lines. This output shows that virtually *no* human male would have the strength necessary in *any* of these six joints to perform the task as modeled. In comparison, Figure 2 shows the output from Dr. Strauss' model showing elongated bars indicating that the vast majority of the male population can safely perform this task. Considering that Dr. Herrin's model shows that no one can do this task, how is it accomplished day-to-day, by various people? How was Mr. Nichols able to hold on to the haul-out line, enduring severe pain, and tie it down

without losing his grip and without falling down? Either he has Herculean strength or Dr. Herrin's model is not a faithful representation of reality. This same model is then used by Dr. Herrin as the foundation for the next two sub-task analyses.

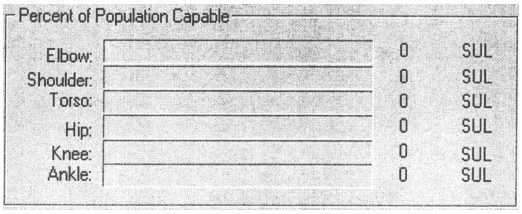

Figure 1. Dr. Herrin's model showing no male would have the strength to perform the task he modeled.

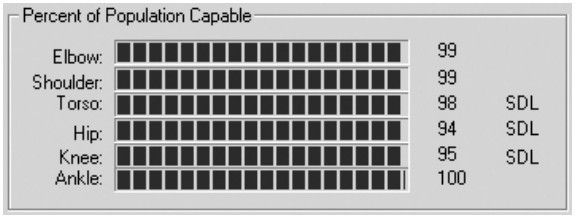

Figure 2. Alternative modeling output showing percent of male population who have the strength to do this task.

b) The second sub-task modeled by Dr. Herrin is labeled "Nichols2." The data input pages show that this is a model of a person crouched and leaning backwards. The arms are outstretched approximately horizontally and directly in front of the center of the chest. The human model is pulling against a 178 pound force.

As stated previously, the *magnitude* of 178 pounds is never felt by Mr. Nichols at any time – a maximum load of 35 pounds was measured. Thus the magnitude of the applied load in this sub-task is incorrect.

As in sub-task one above, the *direction* of the 178 pound load on the hands has been applied horizontally. This is again incorrect for the same reasons.

c) The third sub-task modeled by Dr. Herrin is labeled "Nichols3." The data input pages show that this is a model of a person crouched and leaning backwards. The arms are outstretched forward and downward at an approximate angle of 45 degrees below the horizontal, and directly in front of the center of the chest. The human model is pulling against a 178 pound horizontal force.

As stated previously, the *magnitude* of 178 pounds is never felt by Mr. Nichols at any time – a maximum load of 35 pounds was measured. Thus the magnitude of the applied load in this sub-task is incorrect.

As in both sub-tasks above, the *direction* of the 178 pound load on the hands has been applied horizontally. This is again incorrect for the same reasons.

Lastly, in comparison to the videotape showing the dock hand performing this sub-task, his body orientation is greatly different than that which was modeled.

3. Because of the incorrect inputs to Dr. Herrin above three models, the results have no value. More accurate modeling of the workers' body position, force direction and magnitude shows that the task that Mr. Nichols was performing was safe if performed in a reasonable manner. Shoulder torques and strength requirements were all safe, which is contrary to Dr. Herrin's findings.

If one was to set aside the results of all the modeling performed by Dr. Herrin and myself, and instead examine only the videotape of the deck hands performing their work, from a trained eye, it is clear that this is not a taxing or even remotely dangerous task. It is clear that little effort is needed, and it is seen at one point in the videotape that the lower deck hand is pulling on the haul-out line with one hand - - not in a crouched position, not leaning backwards, not losing his balance and not slipping on the deck. This is certainly not something that he could have done if there was 178 pounds pulling on the haul-out line. If there truly was an impact load of 178 pounds, it is more likely than not that any deck hand would not have been able to maintain his grasp on the cable and it would have been abruptly yanked from his hands. According to Mr. Nichols and his nearby deck hand, Mr. Nichols did not drop the haul-out line.

Loading on the Cervical Spine According to Dr. Herrin

There is much to say about what Dr. Herrin opines in his report regarding cervical spine forces in Mr. Nichols during the haul-out line transfer. For the sake of clarity, I am quoting directly from Dr. Herrin's report.

> The compressive loadings on the spine also exceed safe limits. While an exact estimate of the compressive load on the C5-6 and C6-7 discs, in particular, is unavailable, it is clear that the compressive loading on the spine would exceed compression loading guidelines of 770 lbs throughout the spine. For example, the estimated loading on the lower lumbar spine (L5-S1) are estimated at 1740 lbs or 2.25 times acceptable isometric limits (770#).

1- It is important to realize that everything in the above paragraph is written based upon the erroneous models and useless results that were obtained from these models.

2- The 3D SSPP program predicts forces and moments only in the lumbar and sacral spine -- it predicts nothing in the cervical spine. In the entire 82 page 3D SSPP User's Manual, the word 'cervical' does not even appear.

3- It is not possible to extrapolate what the forces in the cervical spine would be based upon an estimate (especially an incorrect estimate) of the forces in the lumbar or sacral spine, as Dr. Herrin does. A fundamental, qualitative biomechanics analysis would show that the tensile forces on the arms from pulling would translate into shear and bending forces in the thoracic, lumbar and sacral spine due to the ground reaction force at the feet. Since the head is not in contact with other objects in the environment, there is no reaction force at the head thus reaction loads would not be present in the cervical spine. See Figure 3.

4- The compression loading guideline of 770 pounds that is referred to by Dr. Herrin was developed and used by NIOSH to assess stress in the L5-S1 disk to reduce the incidence of low back injury in manual lifting. This does not relate to the cervical spine.

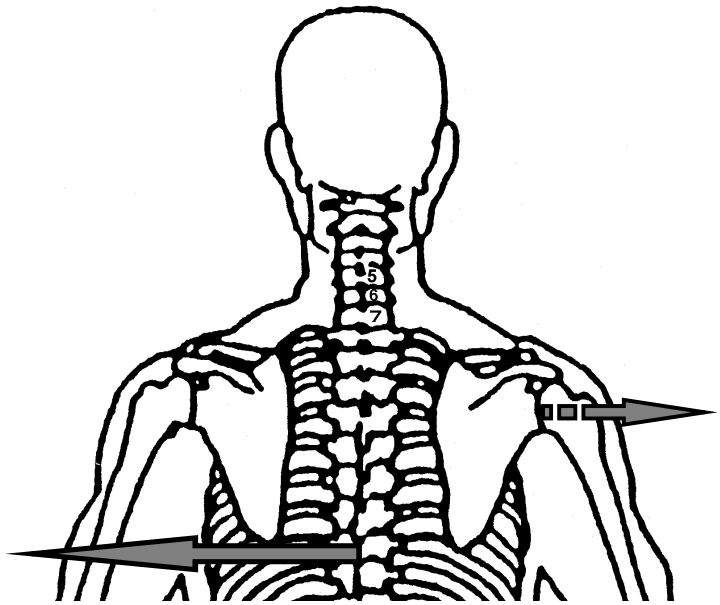

Figure 3. External load on arm balanced by reaction forces in the spine segments below the arm.

Injury Causation

A sudden traumatic event as described by Mr. Nichols, and causing a rotator cuff tear and extreme damage to the glenoid labrum would certainly be a very painful event. Yet according to testimony, Mr. Nichols did not drop the haul-out line and continued to attach it to the timberhead. I find this to be quite unusual.

Mr. Nichols had a right acromioplasty due to impingement. This is an anatomic condition, not one created by the environment. It is also known that rotator cuff tears are not uncommon with impingement conditions.

Mr. Nichols stated in his deposition that he hunts, lifts weights and played softball with his children. Given the fact that he is right hand dominant, if he hunts with a rifle or shotgun, the recoil can cause right shoulder injury. Similarly, weight lifting can also cause shoulder injury. Shoulder instability and labral lesions in particular, have been documented in people involved in overhead sports, specifically baseball.

Review of Mr. Campana's Report

In the report by Mr. Campana, the section titled, "Summary of Facts and Opinions -1" contains a statement that says the height difference between the two barges was greater than eight feet. As seen in the photograph in Figure 4, the height difference in the barges during my inspection, at the point of the timberheads, is less than the standing height of the lower deck hand. The height difference was measured to be 5 ' 10".

Figure 4. Barge height difference.

Mr. Campana leads the reader of his report to believe that because the length of the haul-out line is 175 feet from the barge to the cell it is directed to, and the line weighs approximately one pound per foot, that the deck hands are carrying 175 pounds. Nonsense! If the line force was 175 pounds, or probably even 75 pounds, the upper deck hand would not be able to remove the line from the empty barge timberhead. And then he would not be able to walk the width of the barge and pass it to the lower deck hand. Observing the kinematics of the two deck hands during the transfer procedure demonstrates that the line load is easily handled and comports with the line force that I measured of 27-35 pounds.